



National Semiconductor

CROSSVOLT Logic Series

Product Reference Guide

May 1995



National Semiconductor

CROSSVOLT™ Logic Series

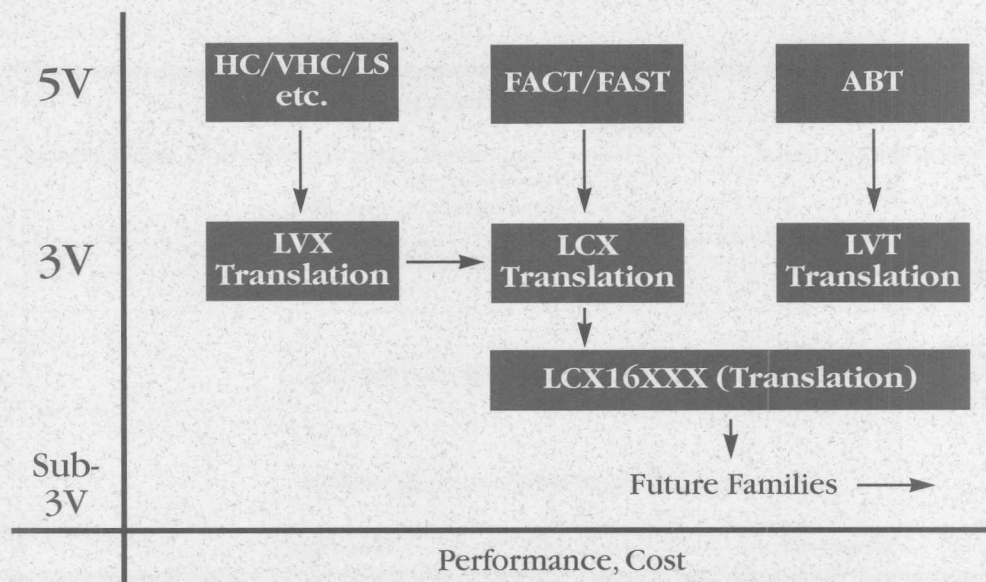
CROSSVOLT (kros'volt) adj. [cross+voltage] providing translation (not frustration) between different digital signal levels (e.g. 5V to 3.3V translation) in order to ease the migration from one signal level to another.

Table of Contents

| | |
|------------------------------|---------|
| <i>Portfolio Overview</i> |3 |
| <i>Logic Function</i> |7 |
| <i>Packaging Guide</i> |11 |
| <i>Cross Reference Guide</i> |17 |
| <i>Order Information</i> |31 |
| <i>What is Translation?</i> |33 |

Portfolio Overview

CROSSVOLT Portfolio At-A-Glance



Selection By Application

| | General Purpose | High Performance | Backplane Driving | Special Translation |
|----------------------|-----------------|------------------|-------------------|-----------------------|
| LV Family | LVX | LCX | LVT | LVX3L384 & LVX4245 |
| 5V Equivalent | HC/VHC | AC/ACQ/FAST | ABT | None |
| Functions | Full Family | Full Family | Bus Functions | Translating Bus |
| Process | CMOS | CMOS | BiCMOS | Varies |
| t_{PD} (max) | 11.5ns | 6.5ns/4.5ns | 4ns | Varies |
| Drive | $\pm 4mA$ | $\pm 24mA$ | +64/-32mA | Varies |
| Competitive Solution | LV | LVC/ALVC | LVT | Quickswitch FCT164245 |
| Price (Normalized) | 1 | 1.5 | 2 | 2 |

Data reflects '245 octal transceiver

CROSSVOLT

LCX Features and Benefits

| Features | Benefits |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| State of the Art Design | High Speed (4.5ns max t_{PD} for 74LCX16245) Flexible: - 5V tolerant inputs and output, interfaces to 3V and 5V devices - 2.0-3.6V supply operation - Power-down high-Z, $\pm 24\text{mA}$ drive |
| 0.8 μ CMOS Process | Extremely low power consumption Low cost |
| Sourced by National, Motorola, Toshiba, and SGS-Thomson | Readily available, de facto standard |

LVX Features and Benefits

| Features | Benefits |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Modern Design | Great cost/performance value - 11.5ns (max) octals 5V tolerant inputs Very low ground bounce 2.0-5.5V supply operation |
| 1.0 μ CMOS Process | Low cost $\pm 4\text{mA}$ Drive - Extremely low noise |
| Sourced by National and Toshiba | Readily available |

LVT Features and Benefits

| Features | Benefits |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Optimized for bus driving | High speed (4.1ns max t_{PD} for 74LVT245) High drive (+64/-32mA) Power up/down High-Z 5V-tolerant inputs and outputs Bus hold |
| 1.0 μ BiCMOS Process | High speed, drive |

Portfolio Overview

LVX4245/3245 Features and Benefits

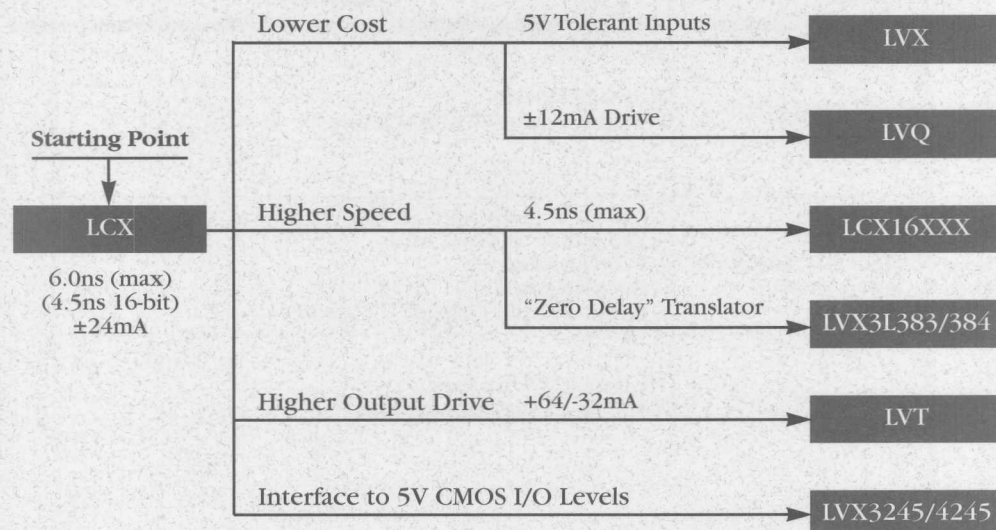
| Features | Benefits |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dual 3.3V/5V Supply Pins | Drives rail-to-rail Will interface to 5V CMOS levels |
| 74LVXC4245/3245 V _{CCB} configurable "on-the-fly" Floating B-port allowed | Great for Modular Applications <ul style="list-style-type: none">- Expansion/daughter cards- PCMCIA interface- Docking stations- Communication outside the system |
| 0.8 μ CMOS Process | High speed (7.5ns max) Very low power consumption |

LVX3L383/3L384 Features and Benefits

| Features | Benefits |
|-------------------|-----------------------------------------------------------|
| 1.0 μ Process | High Speed (250ps max) Very Low Power (10 μ A max) |
| Multiple Sources | Readily available in SOIC, QSOP, and TSSOP packages |

CROSSVOLT

Selecting a CROSSVOLT Family



Logic Function Selection Guide

Gates

| Function/Description | Type | LCX | LVX | LVQ | LVT* |
|------------------------------|------|-----|-----|-----|------|
| Quad 2-Input NAND | 00 | x | x | x | |
| Quad 2-Input AND | 08 | x | x | x | |
| Quad 2-Input NOR | 02 | x | x | x | |
| Hex Inverter | 04 | x | x | x | |
| Hex Inverter with OC Outputs | 05 | x* | | | |
| Triple 3-Input NAND Gate | 10 | x* | | | |
| Triple 3-Input AND Gate | 11 | x* | | | |
| Hex Schmitt Trigger Inverter | 14 | x | x | x | |
| Quad 2-Input OR | 32 | x | x | x | |
| Quad 2-input Exclusive-OR | 86 | x | x | x | |

Flip-Flops

| Function/Description | Type | LCX | LVX | LVQ | LVT* | Data Inputs | TRI-STATE® Outputs | Master Reset |
|----------------------|-------|-----|-----|-----|------|-------------|--------------------|--------------|
| Dual D | 74 | x | x | x | | 2 | No | No |
| Dual JK | 112 | x* | | | | 2 | No | No |
| Hex D | 174 | | x | x | | 6 | No | Yes |
| Octal D | 273 | | x | x | | 8 | No | Yes |
| Octal D | 374 | x | x | x | | 8 | Yes | No |
| Octal D | 574 | x | | | x | 8 | Yes | No |
| 16-Bit D | 16374 | x | | | x | 16 | Yes | No |

Latches

| Function/Description | Type | LCX | LVX | LVQ | LVT* | Data Inputs | Enable Inputs (Level) | TRI-STATE® Outputs | Flow Through |
|--------------------------|-------|-----|-----|-----|------|-------------|-----------------------|--------------------|--------------|
| Octal Transparent Latch | 373 | x | x | x | | 8 | 1(H) | Yes | No |
| Octal Transparent Latch | 573 | | x | x | x | 8 | 1(L) | Yes | Yes |
| 16-Bit Transparent Latch | 16373 | x | | | x | 16 | 2(H) | Yes | No |

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Buffers/Line Drivers

| Function/Description | Type | LCX | LVX | LVQ | LVT* | Active Add. Inputs | Inverting Non-Inverting |
|----------------------------------------|--------|-----|-----|-----|------|--------------------|-------------------------|
| Quad Buffer | 125 | x | x | x | | 4(L) | N |
| Octal Buffer/Line Driver | 240 | x | x | x | x | 2(L) | I |
| Octal Buffer/Line Driver | 241 | | | x | | 1(L)+1(H) | N |
| Octal Buffer/Line Driver | 244 | x | x | x | x | 2(L) | N |
| Octal Inverting Buffer/Line Driver | 540 | x* | | | | 2(L) | I |
| Octal Buffer/Line Driver | 541 | x* | | | | 2(L) | N |
| 16-Bit Buffer/Line Driver | 16240 | x | | | x | 4(L) | I |
| 16-Bit Buffer/Line Driver | 16244 | x | | | x | 4(L) | N |
| 16-Bit Buffer/Line Driver w/25 Ohm Res | 162244 | | | | x | 2(L) | N |

Decoders/Demultiplexers

| Function/Description | Type | LCX | LVX | LVQ | LVT* | Enable | Active Address Input | Outputs |
|------------------------------|------|-----|-----|-----|------|-----------|----------------------|---------|
| 1-of-8 Decoder/Demultiplexer | 138 | x | x | x | | 2(L)+1(H) | 3 | 8 |

Multiplexers

| Function/Description | Type | LCX | LVX | LVQ | LVT* | Enable Inputs (Level) | TRUE Output | Complement Output |
|--------------------------|------|-----|-----|-----|------|-----------------------|-------------|-------------------|
| 8-Input Multiplexer | 151 | | | x | | 1(L) | Yes(1) | Yes(1) |
| Quad 2-Input Multiplexer | 157 | x* | x | x | | 1(L) | Yes(4) | No |
| Quad 2-Input Multiplexer | 257 | x* | | | | 1(L) | Yes(4) | No |

Logic Function Selection Guide

Transceiver/Registers

| Function/ Description | Type | LCX | LVX | LVQ | LVT* | Registers | Enable Input Level | TRI- STATE Outputs |
|-----------------------------------------------|--------|-----|-----|-----|------|-----------|--------------------------|--------------------------|
| Octal Bidirectional Transceiver | 245 | x | x | x | x | No | 1(L) | Yes |
| Octal Registered Transceiver | 543 | x | | | x | Yes | 2(L) | Yes |
| Octal Bus Transceiver and Register | 646 | x | | | x | Yes | 1(L) | Yes |
| Octal Bus Transceiver and Register | 652 | x | | | x | Yes | 1(L) + 1(H) | Yes |
| Octal Registered Transceiver | 2952 | | | | x | Yes | 2(L) | Yes |
| 16-Bit Bidirectional Transceiver | 16245 | x | | | x | No | 2(L) | Yes |
| 18-Bit Universal Transceiver | 16500 | x | | | | Yes | 1(L) + 1(H) | Yes |
| 16-Bit Registered Transceiver | 16543 | x | | | x | Yes | 4(L) | Yes |
| 16-Bit Bus Transceiver and Register | 16646 | x | | | x | Yes | 2(L) | Yes |
| 16-Bit Bus Transceiver and Register | 16652 | x | | | x | Yes | 2(L) + 2(H) | Yes |
| 16-Bit Bidirectional Transceiver w/25 Ohm Res | 162245 | | | | x | No | 1(L) | Yes |

* Planned or in development

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Special Purpose Translators

| Function/ Description | Type | LCX | LVX | LVQ | LVT | TRI- STATE Outputs | 3V or 5V Conf. I/O | Vcca | Vccb |
|--------------------------------|-------|-----|-----|-----|-----|--------------------------|--------------------------|----------|----------|
| Octal Translating Transceivers | 4245 | | x | | | Yes | No | 4.5-5.5V | 2.7-3.6V |
| Octal Translating Transceivers | 3245 | | x | | | Yes | No | 2.7-3.6V | 4.5-5.5V |
| Octal Translating Transceivers | C4245 | | x | | | Yes | Yes | 4.5-5.5V | 2.7-5.5V |
| Octal Translating Transceivers | C3245 | | x | | | Yes | Yes | 2.7-3.6V | 3.0-5.5V |

Bus Switches

| Function/ Description | Type | LCX | LVX | LVQ | LVT | TRI-STATE Outputs | 3V or 5V Conf. I/O | Vcc |
|--------------------------------------------|--------|-----|-----|-----|-----|----------------------|--------------------------|----------|
| 10-Bit Bus Exchange Switches | 3L383 | | x | | | Yes | Yes | 4.0-5.5V |
| 10-Bit Bus Switches | 3L384 | | x | | | Yes | Yes | 4.0-5.5V |
| 10-Bit Extended Input Voltage Bus Switches | 3L384A | | x | | | Yes | Yes | 4.0-5.5V |

GTL-TLL Transceivers

| Function/ Description | Type | t _{PD} AB | I _{CC} | 5V Tolerant | Pwr up/dn hiZ | Prog Edge Rate Ctrl | V _{ref} Options | Vcc |
|---------------------------------------|-------|-----------------------|-----------------|----------------|---------------------|---------------------------|-----------------------------|-------------------|
| 18-Bit Universal Transceiver | 16612 | 4ns | 31mA | Y | Y | Option | 0.8V or 1.0V | 3.3V, 5V, or Both |
| 17-Bit Universal Trans w/Clock Buffer | 16616 | 4ns | 31mA | Y | Y | Option | 0.8V or 1.0V | 3.3V, 5V, or Both |

Packaging Guide

| Type | Lead Count | LCX | LVX | LVQ | LVT* |
|------|------------|----------------------------|----------------------------|---------------------|------|
| 00 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 02 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 04 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 05 | 14 | SOIC (JEDEC & EIAJ), TSSOP | | | |
| 08 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 10 | 14 | SOIC (JEDEC & EIAJ), TSSOP | | | |
| 11 | 14 | SOIC (JEDEC & EIAJ), TSSOP | | | |
| 14 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 32 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 74 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 86 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 112 | 16 | SOIC (JEDEC & EIAJ), TSSOP | | | |
| 125 | 14 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 126 | 14 | | | | |
| 138 | 16 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 151 | 16 | | | SOIC (JEDEC & EIAJ) | |

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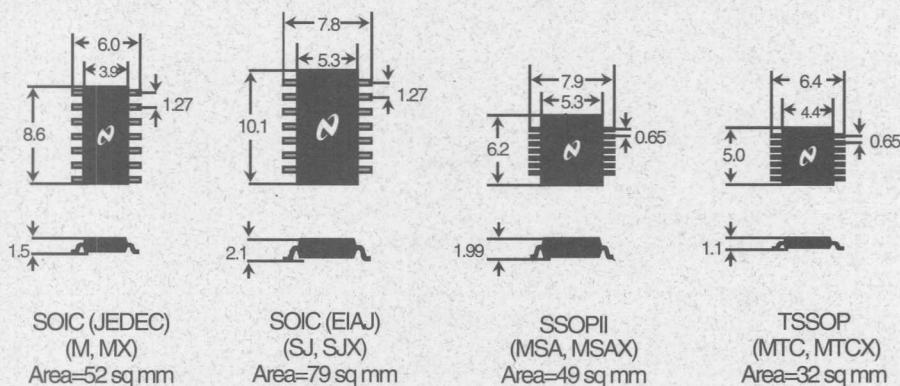
| Type | Lead Count | LCX | LVX | LVQ | LVT* |
|------|------------|----------------------------------|----------------------------|---------------------------|----------------------------------|
| 157 | 16 | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 174 | 16 | | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ) | |
| 240 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 241 | 20 | | | SOIC (JEDEC & EIAJ), QSOP | |
| 244 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 245 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 257 | 16 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | | | |
| 273 | 20 | | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | |
| 373 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 374 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 540 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | | | |
| 541 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | | | |
| 543 | 24 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | | | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 573 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | SOIC (JEDEC & EIAJ), TSSOP | SOIC (JEDEC & EIAJ), QSOP | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 574 | 20 | SOIC (JEDEC & EIAJ), SSOP, TSSOP | | | SOIC (JEDEC & EIAJ), SSOP, TSSOP |
| 646 | 24 | SOIC (JEDEC), TSSOP | | | SOIC (JEDEC), TSSOP |

Packaging Guide

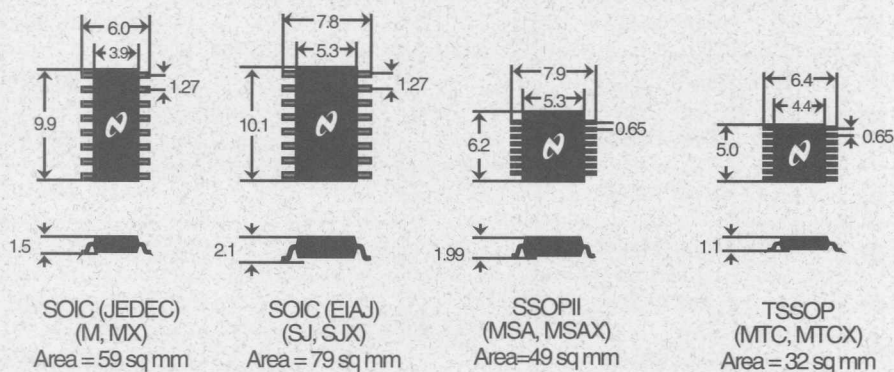
| Type | Lead Count | LCX | LVX | LVQ | LVT* |
|--------|------------|------------------------|------------------------------|-----|------------------------|
| 652 | 24 | SOIC (JEDEC), TSSOP | | | SOIC (JEDEC), TSSOP |
| 2952 | 24 | | | | |
| 3245 | 24 | | SOIC (JEDEC), QSOP | | |
| 4245 | 24 | | SOIC (JEDEC), QSOP | | |
| C3245 | 24 | | SOIC (JEDEC), QSOP | | |
| C4245 | 24 | | SOIC (JEDEC), QSOP | | |
| 3L383 | 24 | | SOIC (JEDEC), QSOP, TSSOP | | |
| 3L384 | 24 | | SOIC (JEDEC), QSOP, TSSOP | | |
| 16240 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16244 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16245 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16373 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16374 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16500 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16543 | 48 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16646 | 56 | SSOP, TSSOP | | | SSOP, TSSOP |
| 16652 | 56 | SSOP, TSSOP | | | SSOP, TSSOP |
| 162244 | 48 | | | | SSOP, TSSOP |
| 162245 | 48 | | | | SSOP, TSSOP |

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14 Lead



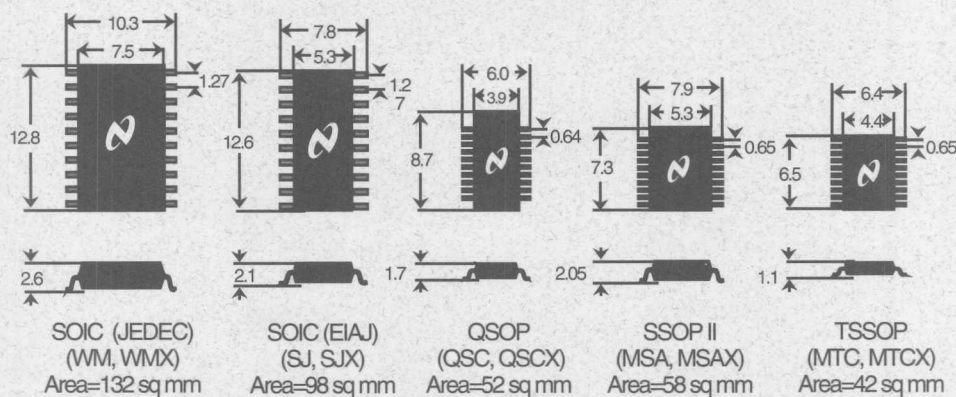
16 Lead



Packaging Guide

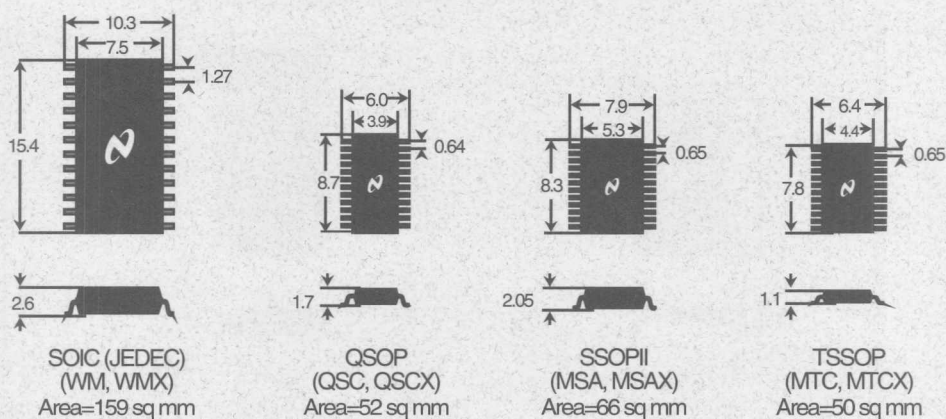
Dimensions in millimeters
To scale but not actual size

20 Lead



Dimensions in millimeters

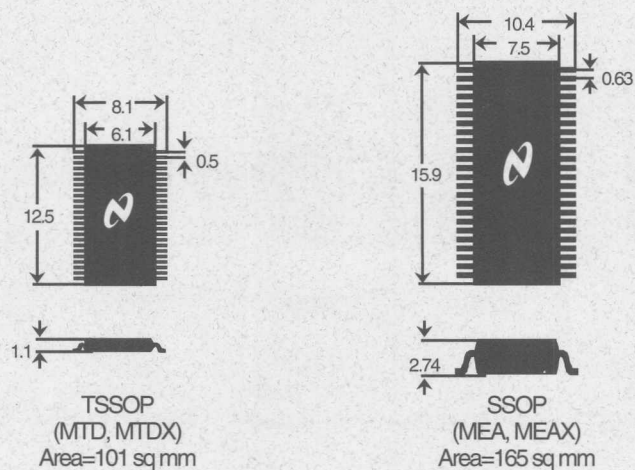
24 Lead



Dimensions in millimeters

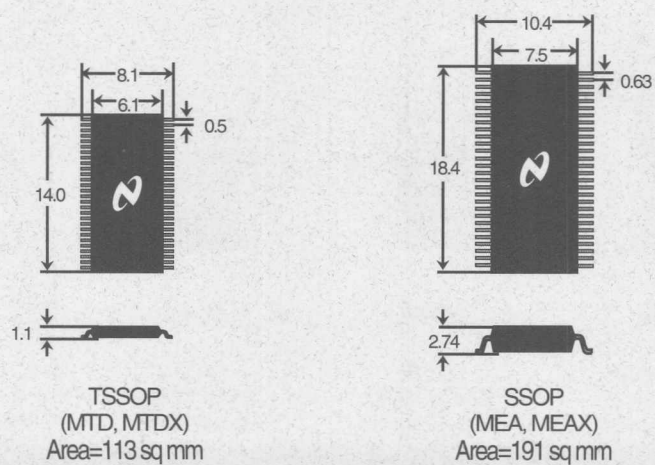
CROSSVOLT

48 Lead



Dimensions in millimeters

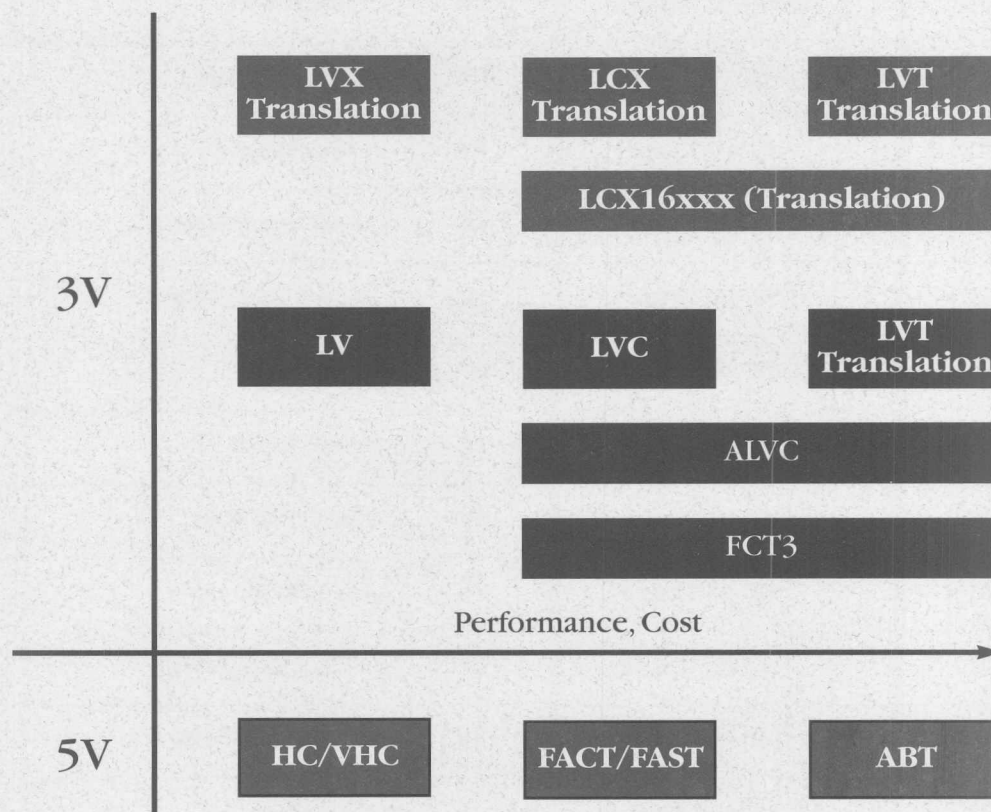
56 Lead



Dimensions in millimeters

Cross Reference Guide

Cross Reference At-A-Glance



National

Comp

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| Competitor | Family | Pkg Code | Package |
|------------|--------------|----------|----------------------|
| TI | SN74LVTxxxx | D | JEDEC SOIC |
| TI | SN74LVTxxxx | DB | 5.3mm SSOPII |
| TI | SN74LVTxxxx | DW | Wide JEDEC SOIC |
| TI | SN74LVTxxxx | PW | 4.4mm TSSOP I |
| TI | SN74LVTxxxx | DL | 48/56 7.5mm SSOP III |
| TI | SN74LVTxxxx | DGG | 48/56 6.1mm TSSOP II |
| TI | SN74LVTZxxxx | D | JEDEC SOIC |
| TI | SN74LVTZxxxx | DB | 5.3mm SSOPII |
| TI | SN74LVTZxxxx | DW | Wide JEDEC SOIC |
| TI | SN74LVTZxxxx | PW | 4.4mm TSSOP I |
| TI | SN74LVTZxxxx | DL | 48/56 7.5mm SSOP III |
| TI | SN74LVTZxxxx | DGG | 48/56 6.1mm TSSOP II |
| TI | SN74LVCxxxx | D | JEDEC SOIC |
| TI | SN74LVCxxxx | DB | 5.3mm SSOPII |
| TI | SN74LVCxxxx | DW | Wide JEDEC SOIC |
| TI | SN74LVCxxxx | PW | 4.4mm TSSOP I |
| TI | SN74LVCxxxx | DL | 48/56 7.5mm SSOP III |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|---------------------------------------------------|
| 74LVTxxxx | 74LCXxxxx | M | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MSA | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | WM | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MTC | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MEA | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MTD | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | M | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MSA | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | WM | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MTC | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MEA | Direct replacement. |
| 74LVTxxxx | 74LCXxxxx | MTD | Direct replacement. |
| 74LCXxxxx | | M | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxxx | | MSA | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxxx | | WM | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxxx | | MTC | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxxx | | MEA | Direct replacement. LCX also offers 5V tolerance. |

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| Competitor | Family | Pkg Code | Package |
|------------|---------------|----------|----------------------|
| TI | SN74LVCxxxx | DGG | 48/56 6.1mm TSSOP II |
| TI | SN74LVC4245 | DB | 5.3mm SSOPII |
| TI | SN74LVC4245 | DW | Wide JEDEC SOIC |
| TI | SN74LVC4245 | PW | 4.4mm TSSOP I |
| TI | SN74ALVC16xxx | DL | 48/56 7.5mm SSOP III |
| TI | SN74ALVC16xxx | DGG | 48/56 6.1mm TSSOP II |
| TI | SN74LVxxxx | D | JEDEC SOIC |
| TI | SN74LVxxxx | DB | 5.3mm SSOPII |
| TI | SN74LVxxxx | DW | Wide JEDEC SOIC |
| TI | SN74LVxxxx | PW | 4.4mm TSSOP I |
| TI | SN74CBT3383 | DB | 5.3mm SSOPII |
| TI | SN74CBT3383 | DW | Wide JEDEC SOIC |
| TI | SN74CBT3383 | PW | 4.4mm TSSOP I |
| TI | SN74CBT3384 | DB | 5.3mm SSOPII |
| TI | SN74CBT3384 | DW | Wide JEDEC SOIC |
| TI | SN74CBT3384 | PW | 4.4mm TSSOP I |
| TI | SN74GTL16xxx | DL | 48/56 7.5mm SSOP III |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|-----------------------------------------------------------------------------------------------|
| 74LCXxxxxx | | MTD | Direct replacement. LCX also offers 5V tolerance. |
| 74LVX4245 | | (QSC) | Use QSOP package. (Not footprint compatible) |
| 74LVX4245 | | WM | Similar replacement. |
| 74LVX4245 | | (QSC) | Use QSOP package. (Not footprint compatible) |
| 74LCX16xxx | | MEA | ALVC is slightly faster, but does not have 5V tolerance. |
| 74LCX16xxx | | MTD | ALVC is slightly faster, but does not have 5V tolerance. |
| 74LVXxxx | 74LVQxxx | M | LVX has 4mA output drive instead of 6mA for LV, but LVX is faster and has 5V tolerant inputs. |
| 74LVXxxx | 74LVQxxx | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LVXxxx | 74LVQxxx | WM | LVX has 4mA output drive instead of 6mA for LV, but LVX is faster and has 5V tolerant inputs. |
| 74LVXxxx | 74LVQxxx | MTD | LVX has 4mA output drive instead of 6mA for LV, but LVX is faster and has 5V tolerant inputs. |
| 74LVX3L383 | | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LVX3L383 | | WM | Direct replacement. Our parts have lower power denoted by the "L" in the part number. |
| 74LVX3L383 | | MTC | Direct replacement. Our parts have lower power denoted by the "L" in the part number. |
| 74LVX3L384 | | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LVX3L384 | | WM | Direct replacement. Our parts have lower power denoted by the "L" in the part number. |
| 74LVX3L384 | | MTC | Direct replacement. Our parts have lower power denoted by the "L" in the part number. |
| GTL16XXX | | MEA | In development. |

CROSSVOLT

| Competitor | Family | Pkg Code | Package |
|------------|---------------|----------|----------------------------|
| TI | SN74GTL16xxx | DGG | 48/56 6.1mm TSSOP II |
| Philips | 74LVTxxxx/A/B | D | JEDEC SOIC/Wide JEDEC SOIC |
| Philips | 74LVTxxxx/A/B | DB | 5.3mm SSOPII |
| Philips | 74LVTxxxx/A/B | PW | 4.4mm TSSOP I |
| Philips | 74LVTxxxx/A/B | DL | 48/56 7.5mm SSOP III |
| Philips | 74LVTxxxx/A/B | DGG | 48/56 6.1mm TSSOP II |
| Philips | 74LVCxxxx | D | JEDEC SOIC |
| Philips | 74LVCxxxx | DB | 5.3mm SSOPII |
| Philips | 74LVCxxxx | PW | 4.4mm TSSOP I |
| Philips | 74LVCxxxx | DL | 48/56 7.5mm SSOP III |
| Philips | 74LVCxxxx | DGG | 48/56 6.1mm TSSOP II |
| Philips | 74LVC4245 | D | JEDEC SOIC |
| Philips | 74LVC4245 | DB | 5.3mm SSOPII |
| Philips | 74LVC4245 | PW | 4.4mm TSSOP I |
| Philips | 74ALVC16xxx | DL | 48/56 7.5mm SSOP III |
| Philips | 74ALVC16xxx | DGG | 48/56 6.1mm TSSOP II |
| Philips | 74LVxxxx | N | PDIP |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|------------------------------------------------------------------------------|
| GTL16XXX | | MTD | In development. |
| 74LVTxxxxx | 74LCXxxxx | M/WM | Direct replacement. |
| 74LVTxxxxx | 74LCXxxxx | MSA | Direct replacement. |
| 74LVTxxxxx | 74LCXxxxx | MTC | Direct replacement. |
| 74LVTxxxxx | 74LCXxxxx | MEA | Direct replacement. |
| 74LVTxxxxx | 74LCXxxxx | MTD | Direct replacement. |
| 74LCXxxxxx | | M/WM | Direct replacement. LCX also offers 5V inputs and outputs. |
| 74LCXxxxxx | | MSA | Direct replacement. LCX also offers 5V inputs and outputs. |
| 74LCXxxxxx | | MTC | Direct replacement. LCX also offers 5V inputs and outputs. |
| 74LCXxxxxx | | MEA | Direct replacement. LCX also offers 5V inputs and outputs. |
| 74LCXxxxxx | | MTD | Direct replacement. LCX also offers 5V inputs and outputs. |
| 74LVX4245 | | WM | Similar replacement. |
| 74LVX4245 | | (QSC) | Use QSOP package. (Not footprint compatible) |
| 74LVX4245 | | (QSC) | Use QSOP package. (Not footprint compatible) |
| 74LCX16xxx | | MEA | ALVC is slightly faster, but LCX16xxx offers 5V tolerant inputs and outputs. |
| 74LCX16xxx | | MTD | ALVC is slightly faster, but LCX16xxx offers 5V tolerant inputs and outputs. |
| | | (M/WM) | Use SOIC. (Not footprint compatible) |

CROSSVOLT

| Competitor | Family | Pkg Code | Package |
|-------------------|-----------------|----------|----------------------------|
| Philips | 74LVxxxx | D | JEDEC SOIC/Wide JEDEC SOIC |
| Philips | 74LVxxxx | DB | 5.3mm SSOPII |
| Philips | 74LVxxxx | PW | 4.4mm TSSOP I |
| IDT | IDT74FCT3xxx | P | PDIP |
| IDT | IDT74FCT3xxx | SO | JEDEC SOIC |
| IDT | IDT74FCT3xxx | PY | 5.3mm SSOPII |
| IDT | IDT74FCT3xxxA | P | PDIP |
| IDT | IDT74FCT3xxxA | SO | JEDEC SOIC |
| IDT | IDT74FCT3xxxA | PY | 5.3mm SSOPII |
| IDT | IDT74FCT163xxx | PV | 48/56 7.5mm SSOP III |
| IDT | IDT74FCT163xxxA | PV | 48/56 7.5mm SSOP III |
| Pericom (Pioneer) | PI74FCT163xxxT | V | 48/56 7.5mm SSOP III |
| Pericom (Pioneer) | PI74FCT163xxxT | A | 48/56 6.1mm TSSOP II |
| Pericom (Pioneer) | PI74FCT163xxxAT | V | 48/56 7.5mm SSOP III |
| Pericom (Pioneer) | PI74FCT163xxxAT | A | 48/56 6.1mm TSSOP II |
| Pericom (Pioneer) | PI5C3383 | P | PDIP |
| Pericom (Pioneer) | PI5C3383 | S | Wide JEDEC SOIC |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|-----------------------------------------------------------------------------------------------|
| 74LVXxxx | 74LVQxxx | M/WM | LVX has 4mA output drive instead of 6mA for LV, but LVX is faster and has 5V tolerant inputs. |
| 74LVXxxx | | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LVXxxx | 74LVQxxx | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LCXxxx | | (M/WM) | Use SOIC. (Not footprint compatible) |
| 74LCXxxx | | M/WM | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxx | | MSA | Direct replacement. LCX also offers 5V tolerance. |
| 74LCXxxx | | (M/WM) | Use SOIC. (Not footprint compatible) |
| 74LCXxxx | | M/WM | FCT/A slightly faster, but LCX also offers 5V tolerance. |
| 74LCXxxx | | MSA | FCT/A slightly faster, but LCX also offers 5V tolerance. |
| 74LCX16xxx | | MEA | Direct Replacement. |
| 74LCX16xxx | | MEA | Direct Replacement. |
| 74LCX16xxx | | MEA | Direct Replacement. |
| 74LCX16xxx | | MTD | Direct Replacement. |
| 74LCX16xxx | | MEA | Direct Replacement. |
| 74LCX16xxx | | MTD | Direct Replacement. |
| 74LVX3L383 | | (WM) | Use SOIC. (Not footprint compatible) |
| 74LVX3L383 | | WM | Direct Replacement. |

CROSSVOLT

| Competitor | Family | Pkg Code | Package |
|-------------------------|----------------|----------|-----------------|
| Pericom (Pioneer) | PI5C3383 | Q | QSOP |
| Pericom (Pioneer) | PI5C3384A | P | PDIP |
| Pericom (Pioneer) | PI5C3384A | S | Wide JEDEC SOIC |
| Pericom (Pioneer) | PI5C3384A | Q | QSOP |
| Quality Semi | QS74FCT3xxx | SO | JEDEC SOIC |
| Quality Semi | QS74FCT3xxx | Q | QSOP |
| Quality Semi | QS74FCT3xxxA | SO | JEDEC SOIC |
| Quality Semi | QS74FCT3xxxA | Q | QSOP |
| Quality Semi | QS74FCT163xxxA | Q2 | QVSOP |
| Quality Semi | QS3383/QS3L383 | P | PDIP |
| Quality Semi | QS3383/QS3L383 | SO | Wide JEDEC SOIC |
| Quality Semi | QS3383/QS3L383 | Q | QSOP |
| Quality Semi | QS3384/QS3L384 | P | PDIP |
| Quality Semi | QS3384/QS3L384 | SO | Wide JEDEC SOIC |
| Quality Semi | QS3384/QS3L384 | Q | QSOP |
| Cypress (& Performance) | CYBUS3384 | P | PDIP |
| Cypress (& Performance) | CYBUS3384 | SO | Wide JEDEC SOIC |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|-----------------------------------------------------------------------|
| 74LVX3L383 | | QSC | Direct Replacement. |
| 74LVX3L384 | | (WM) | Use SOIC. (Not footprint compatible) |
| 74LVX3L384 | | WM | Direct Replacement. |
| 74LVX3L384 | | QSC | Direct Replacement. |
| 74LCXxxxxx | | M/WM | Direct Replacement. |
| 74LCXxxxxx | | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LCXxxxxx | | M/WM | FCT/A slightly faster, but LCX offers 5V tolerant inputs and outputs. |
| 74LCXxxxxx | | (MTC) | Use TSSOP package. (Not footprint compatible) |
| 74LCX16xxx | | (MTD) | Use TSSOP package. (Not footprint compatible) |
| 74LVX3L383 | | (WM) | Use SOIC. (Not footprint compatible) |
| 74LVX3L383 | | WM | Direct Replacement. "L" means low power version. |
| 74LVX3L383 | | QSC | Direct Replacement. "L" means low power version. |
| 74LVX3L384 | | (WM) | Use SOIC. (Not footprint compatible) |
| 74LVX3L384 | | WM | Direct Replacement. "L" means low power version. |
| 74LVX3L384 | | QSC | Direct Replacement. "L" means low power version. |
| 74LVX3L384 | | (WM) | Use SOIC. (Not footprint compatible) |
| 74LVX3L384 | | WM | Direct Replacement. |

CROSSVOLT

| Competitor | Family | Pkg Code | Package |
|-------------------------|------------|----------|-----------------|
| Cypress (& Performance) | CYBUS3384 | Q | QSOP |
| Motorola | MC74LVTxxx | DW | Wide JEDEC SOIC |
| Motorola | MC74LVTxxx | DT | 4.4mm TSSOP I |
| Motorola | MC74LCXxxx | DW | Wide JEDEC SOIC |
| Motorola | MC74LCXxxx | M | EIAJ SOIC |
| Motorola | MC74LCXxxx | DT | 4.4mm TSSOP I |
| Toshiba | TC74LCXxxx | FN | JEDEC SOIC |
| Toshiba | TC74LCXxxx | FW | Wide JEDEC SOIC |
| Toshiba | TC74LCXxxx | F | EIAJ SOIC |
| Toshiba | TC74LCXxxx | FS | 4.4mm SSOP I |
| Toshiba | TC74LVXxxx | FN | JEDEC SOIC |
| Toshiba | TC74LVXxxx | FW | Wide JEDEC SOIC |
| Toshiba | TC74LVXxxx | F | EIAJ SOIC |
| Toshiba | TC74LVXxxx | FS | 4.4mm SSOP I |
| Toshiba | TC74LVQxxx | FN | JEDEC SOIC |
| Toshiba | TC74LVQxxx | FW | Wide JEDEC SOIC |
| Toshiba | TC74LVQxxx | F | EIAJ SOIC |

Cross Reference Guide

See important note on page 30

| National Replacement | Alternate | Pkg Code | Comments |
|----------------------|-----------|----------|------------------------------------------------------------------------|
| 74LVX3L384 | | QSC | Direct Replacement. |
| 74LVTxxxx | | WM | Direct Replacement. |
| 74LVTxxxx | | MTC | Direct Replacement. |
| 74LCXxxxx | | WM | Direct Replacement. |
| 74LCXxxxx | | SJ | Direct Replacement. |
| 74LCXxxxx | | MTC | Direct Replacement. |
| 74LCXxxxx | | M | Direct Replacement. |
| 74LCXxxxx | | WM | Direct Replacement. |
| 74LCXxxxx | | SJ | Direct Replacement. |
| 74LCXxxxx | | MTC | Direct Replacement. Our TSSOP is footprint compatible with their SSOP. |
| 74LVXxxxx | | M | Direct Replacement. |
| 74LVXxxxx | | WM | Direct Replacement. |
| 74LVXxxxx | | SJ | Direct Replacement. |
| 74LVXxxxx | | MTC | Direct Replacement. Our TSSOP is footprint compatible with their SSOP. |
| 74LVQxxxx | | M | Direct Replacement. |
| 74LVQxxxx | | WM | Direct Replacement. |
| 74LVQxxxx | | SJ | Direct Replacement. |

CROSSVOLT

Important Note:

National Semiconductor does not guarantee device compatibility and does not assume liability for device incompatibility either stated or implied by this document. Device compatibility must be verified by the user.

* Key to all tables in Cross Reference Guide

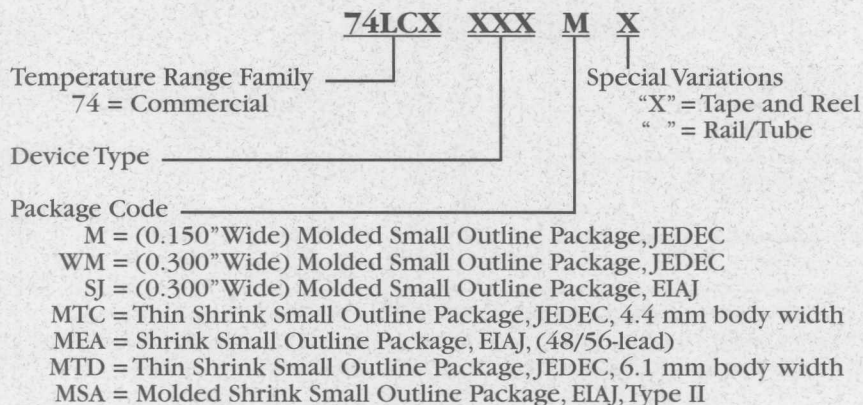
Bold: Direct Replacement (see "Important Note" above.)

Italics: Similar Replacement

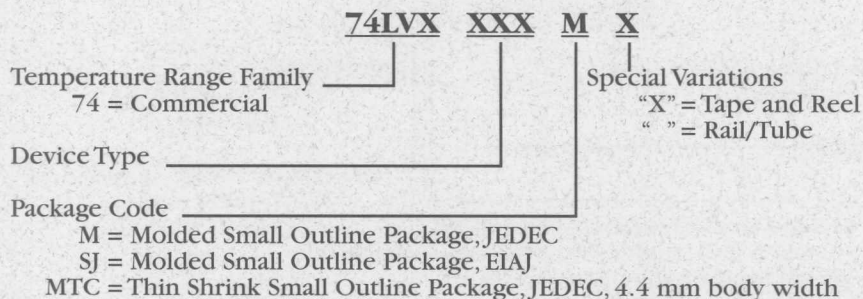
(blank): No replacement or no footprint compatible replacement

Order Information

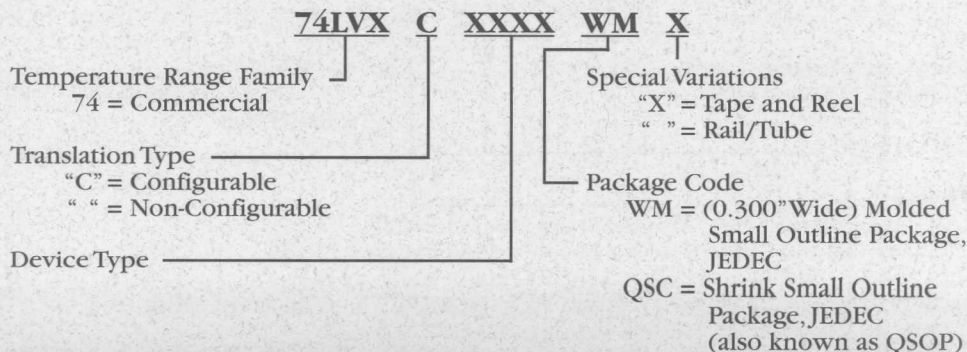
LCX Family



LVX Family

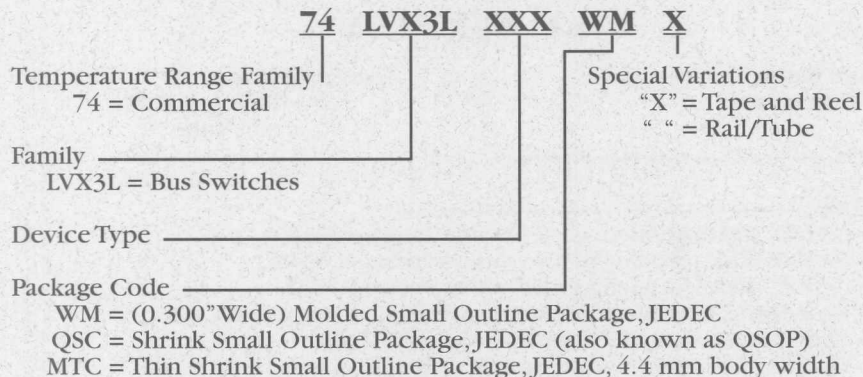


LVX Translators Family

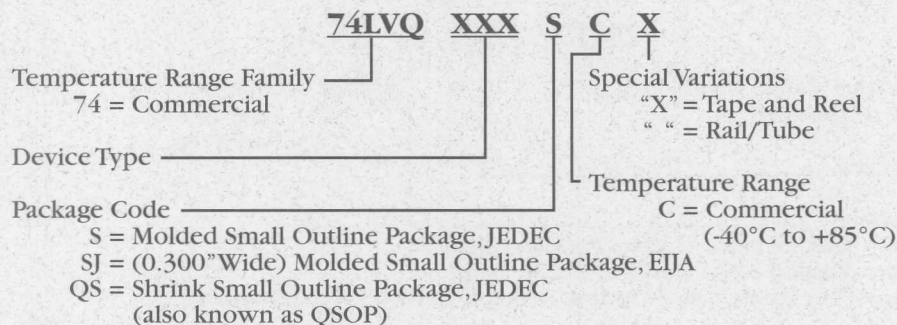


CROSSVOLT

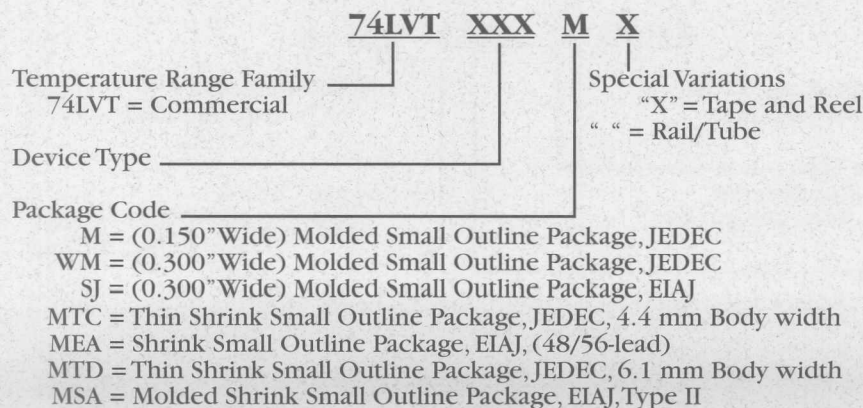
LVX Bus Switch Family



LVQ Family



LVT Family



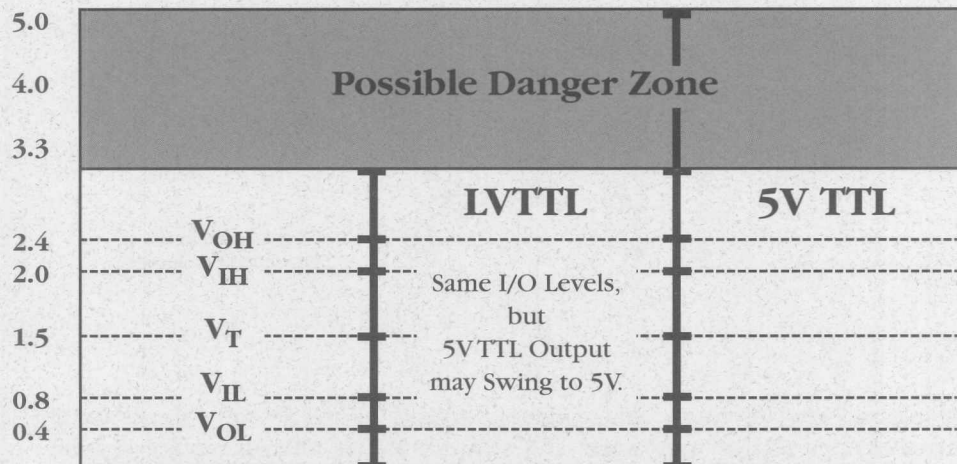
What is Translation?

CROSSVOLT: 3V/5V Translation

In theory, there shouldn't be a need to translate between 5V TTL signals and 3V signals because the voltage levels representing valid "ones" and "zeros" are the same as specified by the JEDEC 5V TTL and LVTTL (low voltage TTL) specifications.

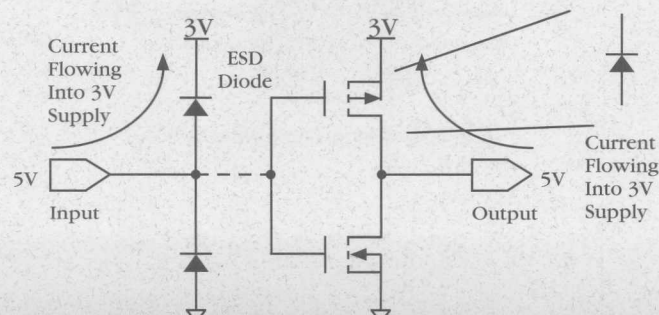
OUTPUT
VOLTAGE

I/O LEVELS



The Problem

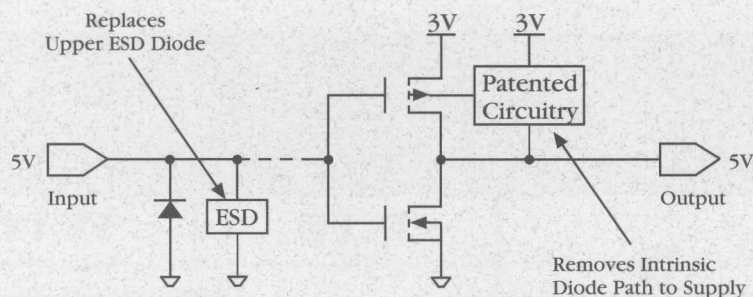
The problem is that a 5V TTL output, when in the high state, can achieve voltages as high as 5 volts which can forward bias ESD (electrostatic discharge) protection diodes and the intrinsic or "hidden" diodes which appear in the CMOS output structures of traditional 3V devices. When forward biased, these diodes can conduct currents as large as 1 amp, damaging the components.



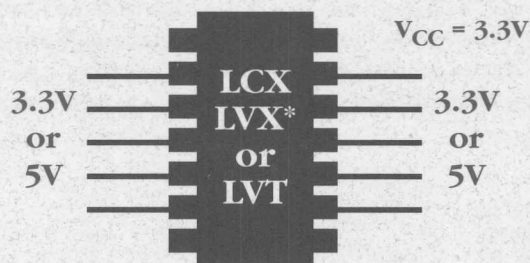
CROSSVOLT

The Solution

5V tolerant circuits, like many of National's *CROSSVOLT* Logic Series devices, eliminate these diode paths and still provide greater than 2000 volts ESD protection.



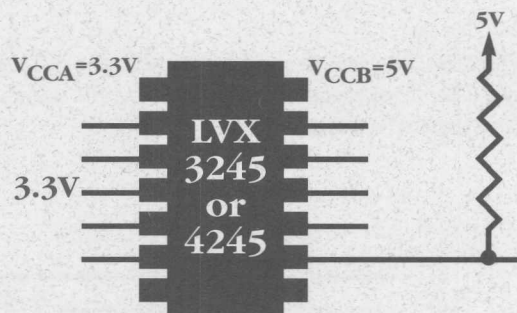
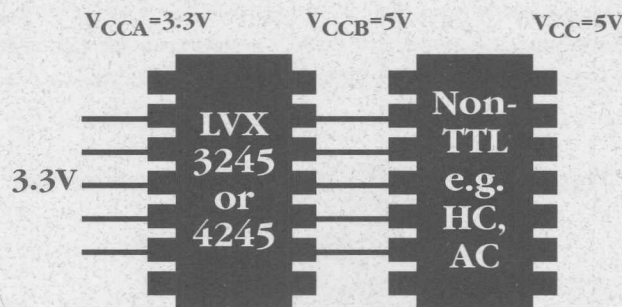
5V tolerant logic devices are able to interface to both 3V and 5V components and are therefore often used as "translators." LCX, LVX, and LVT 5V tolerant families perform equally well in pure 3V as well as mixed 3V/5V environments. These *CROSSVOLT* families can be used in almost all pure 3V and mixed 3V/5V cases.



* LVX is 5V tolerant on inputs only.

Two Special Cases

There are two infrequent exceptions, however, when a dual supply translator, not 5V tolerant logic, is needed: when interfacing to non-TTL compatible signals or when interfacing to components or busses which are pulled up to 5V. Full 0 volt to 5 volt output swings are required in these cases which the dual supply translator can accomplish since it has both a 3V and a 5V supply pin. Use the *CROSSVOLT* 74LVX3245/4245 dual supply translator devices in these two cases.

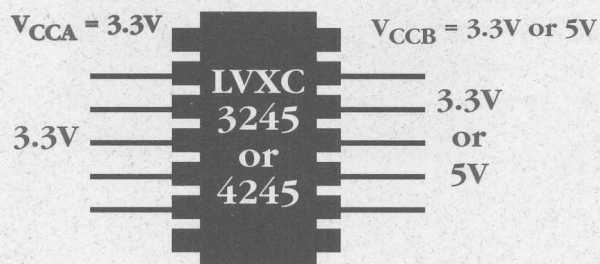


Conclusion

Since you can never be sure when you'll have to interface to a 5V signal, National's LCX, LVX, and LVT families offer 5V tolerance at no extra cost. This means an easy migration from 5V to 3V and sub-3V systems. And, National offers the 74LVX3245/4245 dual supply translators for those special translation needs.

Appendix: Other Possibilities

National's 74LVXC3245 and 74LVXC4245 Configurable Dual Supply Translators offer special support for modular (plug-in) applications. These versions of our dual supply translators feature a configurable VCCB which can be set to either 3.3V or 5V in during system operation. This allows a modular interface to be configured to be either 3V or 5V. These devices also allow their B-port to be left floating when the module/card is unplugged.



National's 74LVX3L384 bus switch can be configured as a 5V protection device. When powered through a diode, this bus switch can clip a 5V signal to a safe $\approx 3.3V$ level with virtually no (250ps) speed impact.

